Write your answers in the answer blank (or circle them). Show all necessary work for full credit. Answers are to be exact values unless stated otherwise.

1. Let $\mathbf{r}(t) = \sqrt{2-t}\,\mathbf{i} + \frac{e^t - 1}{t}\,\mathbf{j} + \ln(t+1)\,\mathbf{k}$

   (a) Determine the domain of $\vec{r}(t)$

   1a. _____

   (b) $\lim\limits_{t \to 0} \mathbf{r}(t)$

   1b. _____

2. Determine the curve of intersection, $\mathbf{r}$, of $x^2 + y^2 = 16$ and $x + z = 5$

3. Let $\mathbf{r}(t) = \langle t^2, t\cos\pi t, \sin\pi t \rangle$, determine the following.

   (a) $\vec{v}(t) =$

   (b) $\vec{a}(t) =$

   (c) $\int_0^1 \mathbf{r}(t)dt =$

   (d) The parametric and symmetric equations of the tangent line to the curve, when $t = \frac{9}{4}$,

4. Determine the length of $\vec{r}(t) = \left\langle 2t^{3/2}, \cos 2t, \sin 2t \right\rangle, 0 \leq t \leq 1$.

5. Given $\mathbf{r}(t) = \left\langle \sin^3 t, \cos^3 t, \sin^2 t \right\rangle$ determine the following:

   (a) **T**

   (b) **N**

   (c) **B**

   (d) the curvature κ

6. Given $y = x^4$ determine the curvature κ